

SECTION 15400

PLUMBING

PART 1 - GENERAL

- 1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- A. American National Standards Institute (ANSI) Publications
 - B. American Society for Testing and Materials (ASTM) Publications
 - C. American Society of Sanitary Engineers (ASSE) Publications
 - D. American Water Works Association (AWWA) Publications
 - E. Cast-Iron Soil Pipe Institute (CISPI) Publications
 - F. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications
 - G. Plumbing and Drainage Institute (PDI) Publications
 - H. ICC International Plumbing Code 2003
 - I. Virginia Uniform Statewide Building Code (VUSBC)
- 1.2 GENERAL REQUIREMENTS: Section 15000, "Mechanical General Provisions", applies to this section, with the additions and modifications specified herein.
- 1.3 DESCRIPTION OF WORK: The work includes [modifying existing and] providing new plumbing systems and related work. The work also includes providing roughing-in and making final plumbing connections to equipment furnished under other sections of this specification. Provide each system complete and ready for operation. Plumbing systems including fixtures, equipment, materials, installation, workmanship, examination, inspection, and testing shall be in accordance with the ICC International Plumbing Code, except as modified herein. In the Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for the word "should" wherever it appears. Capacity of equipment shall be not less than that indicated. Plumbing systems shall include all water and sanitary piping[buried and above ground except water and sanitary piping more than 5 feet outside of the building walls is specified in Division 2.
- 1.4 SUBMITTALS
- A. Submit shop drawings in accordance with 15000, "MECHANICAL GENERAL PROVISIONS".
 - B. Manufacturer's Data:
 - 1. Pipe and fittings
 - 2. Valves
 - 3. Plumbing fixtures
 - 4. Water heaters

5. Pipe supports (hangers)
 6. Pumps
 7. Gages and thermometers
 8. Strainers
 9. Drains
 10. Water hammer arresters
 11. Backflow preventers
 12. Insulation kits for barrier free fixture fittings
- C. Shop Drawings:
1. Access panels
- D. Certificates of Compliance:
1. Pipe and fittings
 2. Valves
 3. Water flushing volume of flushometer and urinal combination
 4. Water flushing volume of flushometer and water closet combination
 5. Backflow preventers
- E. Certified Data:
1. Water heaters
 2. Pump test curves
 3. Backflow preventers
- F. Operation and Maintenance Manuals:
1. Water heaters
 2. Pumps
- G. Posted Operating Instructions:
1. Water heaters
 2. Pumps
- 1.5 INSULATION: Insulate equipment and piping under this section as specified in Section 15250, "Insulation", except as specified herein for barrier free accessible fixtures and fittings.
- 1.6 FIELD PAINTING: Provide under Section "Field Painting".
- 1.7 FLASHING: Provide under Section "Flashing and Sheet Metal".
- 1.8 ELECTRICAL REQUIREMENTS: Furnish motors, controllers, contactors, and starters with their respective pieces of equipment. Motors, controllers, contactors, and starters shall conform to and shall have electrical connections provided under Division 16. Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished. Disconnect switches shall be provided under Division 16 unless specified in this section as integral with equipment. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

PART 2 - PRODUCTS

- 2.1 DWV (DRAIN, WASTE, AND VENT) PIPING: Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.
- A. Buried Piping: Buried piping includes piping up to but not more than 6 inches above ground or floor slab on grade.
1. Cast-Iron Hubless Pipe and Fittings: CISPI 301 with CISPI 310 coupling joints.
 2. Cast-Iron Hub and Spigot Pipe and Fittings: ASTM A 74 with ASTM C 564 rubber compression gasket joints, or caulked and leaded joints.
 3. Plastic Pipe: PVC, (DWV) Schedule 40, ASTM D2665, or ABS Sewer Pipe, ASTM D2661 may be installed as permitted by code. PVC and ABS pipe shall not be installed in locations where temperatures will be above 140 degrees F.
- B. Aboveground Piping:
1. Cast-Iron Hubless Pipe and Fittings: CISPI 301 with CISPI 310 coupling joints.
 2. Cast-Iron Hub and Spigot Pipe and Fittings: ASTM A 74 with ASTM C 564 rubber compression gasket joints, or caulked and leaded joints.
 3. Plastic Pipe: PVC, (DWV) Schedule 40, ASTM D2665 or ABS Sewer Pipe, ASTM D2661 may be installed as permitted by code.
 4. Copper Tubing: ASTM B 306, with ANSI B16.23, ANSI B16.29, or ANSI B16.32 solder joint fittings using ASTM B 32, 95-5 tin-antimony solder.
 5. Steel Pipe: ASTM A 53 or ASTM A 120, Schedule 40, hot-dip galvanized, threaded end connections; with ANSI B16.12 hot-dip galvanized threaded fittings.
- C. Cleanouts: ANSI A112.36.2; provide threaded bronze or thermoplastic cleanout plugs.
1. Floor Cleanouts: Provide cast-iron floor cleanout with flange, polished bronze or nickel bronze rim and scoriated floor plate with CO cast in the plate. Secure floor plate with countersunk screws for installation flush with finished floor.
 2. Wall Cleanouts: Provide polished stainless steel or chromium-plated bronze cover plate and secure to cleanout plug with countersunk screw.
 3. Cleanouts Exterior to Buildings: Provide cast-iron cleanouts and countersunk plugs. Provide 24- by 24- by 4-inch thick concrete slab with top 1.0 inch above grade with cleanout located in center of slab. Provide cast-iron cleanout box with cover.
- D. Drains: ANSI A112.21.1M; provide cast-iron drains and clamping rings for use with membrane waterproofing.
1. Flush Strainer Floor Drains: Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze strainer, adjustable collar, and P-trap. Provide with trap primer connection where indicated.

2. Automatic Trap Primer: Provide automatic floor drain trap primer with integral backflow preventer and vacuum breaker on all floor drains. Precision Plumbing Products, Inc. or approved equal.
 3. Mechanical Room and Area Drains: Provide with heavy-duty cast-iron grate and sediment bucket.
- E. Acid Resistant DWV Pipe, Fittings and Couplings
1. Acid-resistant polypropylene piping shall be manufactured to Schedule 40 P.E. pipe dimensions, for above ground, and Schedule 80 P.E. pipe dimensions for below ground. Pipe shall be fire retardant, to be supplied in 10 ft. lengths. Pipe shall be cylindrical and straight to meet tolerances in accordance with ASTM D 2447-74. Pipe shall be factory grooved for mechanical joint systems and plain end for socket fusion systems. Material shall conform to ASTM D 4101.
 2. Acid-resistant fittings shall be manufactured to Schedule 40 P.E. pipe dimensions of fire retardant polypropylene. Fittings shall conform to tolerances in ASTM D 3311. Material to meet ASTM D 4101.

2.2 DOMESTIC WATER PIPING

- A. Buried Piping and Aboveground Piping:
1. Copper Tubing: ASTM B 88, Type K, with ANSI B16.18 or ANSI B16.22 solder joint fittings using ASTM B 32, grade Sn 96 tin-silver solder and flux containing not more than 0.2 percent lead, or with ANSI B16.26 flared joint fittings. ASTM B 88, Type L, shall be provided for aboveground piping.
- B. Water Valves: Provide valves suitable for minimum of 125 psig and minimum of 180 degrees F hot water in accordance with MSS SP-80-79. Valves shall have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Copper alloy and bronze valve body shall be ASTM B 61 or ASTM B 62 copper alloy. Ball valves may be provided in lieu of gate valves.
1. Acceptable Manufacturers: Valves shall be of one manufacturer for each type of valve. Where valve manufacturers are not specifically indicated below, they shall be one of the following: Crane, Jenkins, Stockham, Nibco, Scott, Grinnel or Red & White.
 2. Valve Connections: Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use line size valves.
 3. Ball Valves: Ball valves used in connection with piping 2 inches in size and smaller, shall have screwed or sweat ends, bronze body, bronze ball and resilient seal. Valve shall be serviceable from either top or end without removing piping. For water service, valves shall be designed for 200 lbs. WOG and 250 degrees F.
 4. Hose Bibbs: Provide angle type copper alloy globe valve with lock-shield and handwheel. Inlet shall have internal threads. Outlet shall have vacuum breaker with 0.75-inch external hose threads.

5. Reduced Pressure Backflow Preventers: Provide ASSE 1013 approved reduced pressure backflow preventers where indicated, as manufactured by Watts 900 Series, or equal by Febco or Conbraco. Provide with air gap fitting piped to nearest floor drain or other approved location.
6. Check Valves: Check valves in piping 2 in. and smaller shall be bronze body, renewable bronze disc screwed or sweat ends, designed for 125 lbs. steam pressure.
7. Vacuum Breakers:
 - a. Hose outlet vacuum breakers - 3/4 in. size, stainless steel and cast brass construction, plated as faucet to which attached, equal to Watts #NF-8.
 - b. Other vacuum breakers - angle, pressure type, brass body, equal to Watts 288A or Nibco 715. Vacuum breakers on chrome-plated piping similarly plated.
8. Vacuum Relief Valves: Bronze body construction with silicone disc equal to Watts model 36A.
9. Pressure Relief Valves: Bronze or cast-iron body, with test lever, and shall be suitable for the intended service.
10. Manual Balance Valves (Hot Water Recirculation System):

Flow Control Balancing Valves: Copper alloy body, copper alloy or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 125 psig at 190 degrees F hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tapings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the gallons per minute flow for each differential pressure reading.
- C. Dielectric Connections: Provide at connections between copper and ferrous metal piping materials. ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 4-inch minimum length, may be provided for dielectric connections in pipe sizes 2 inches and smaller.
- D. Water Hammer Arresters: Expansion bellows type with pressurized compression chamber; ANSI A112.26.1, OR ASSE 1010.
- E. Wall Hydrant: Wall hydrant, exposed type with vacuum breaker/backflow preventer, wall mounted, automatic draining, freezeproof, key operated, polished brass finish on brass casting. Woodford model 65 or approved equal by Zurn or Josam.
- F. Pressure Gauge: Provide single style pressure gage for water with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range suitable for the intended service.
- G. Thermometers: Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 5-inch diameter dial with glass face gasketed within the case;

accuracy within 2 percent of scale range. Provide scale range suitable for the intended service.

2.3 EXPANSION TANK: Drawn steel tank with butyl diaphragm, 150 psi max. working pressure, in-line type, field adjustable air charge, suitable for use in potable domestic cold water systems.

2.4 GAS PIPING

A. Refer to Section 15355, "Fuel Gas Piping".

2.5 MISCELLANEOUS PIPING MATERIALS

A. Pipe Nipples: Copper alloy for use in copper tubing and hot-dip galvanized Schedule 80 steel pipe for use in steel piping.

B. Escutcheon Plates: Provide one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed spaces. Provide chromium-plated finish on plates in finished space. Provide paint finish on plates in unfinished spaces. Securely anchor plates in place with set screws or other approved positive means.

C. Pipe Sleeves: Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

1. Sleeves in Masonry and Concrete: Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth. PVC sleeves shall not be used in walls adjacent to plenum spaces.

2. Sleeves Not in Masonry and Concrete: Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves. PVC sleeves shall not be used in walls adjacent to plenum spaces.

D. Pipe Supports (Hangers): Provide MSS SP-58 and MSS SP-69, Type 1, Type 7, or Type 12, of the adjustable type, except as indicated or specified herein. Provide Type 40 insulation protection shields for insulated piping. Provide steel support rods. Provide nonmetallic, hair felt, or plastic piping isolators between copper tubing and the hangers. Provide flat wide band hangers for un-insulated plastic piping.

E. Access Panels: Provide factory prefabricated and primed steel access panels including 16-gage steel frame with a hinged or snap-on 14-gage steel cover with spring-catch or turn-latch. Provide panel with factory-primed rust-inhibitive paint. the wide-leg or flange of the frame section shall be perforated or shall extend into expanded metal wings to provide a key for plaster. Size and furnish panels under this section to provide proper access to concealed valves and control devices; install panels under the appropriate

section of this specification.

- 2.6 **FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES:** Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated. Zincoalloy or plastic handles will not be permitted for faucets and valves. Provide special roughing-in for wheelchair fixtures. Exposed traps, supplies and stop valves at barrier free fixtures shall be insulated with ANSI and ADA approved, vinyl molded insulation with nylon fastener kits, painted as directed by the Architect. Fixtures shall be as manufactured by American Standard, Kohler or Eljer. Model numbers provided are to indicate desired quality and style, others will be considered if approved equal by the Architect/Engineer.

- A. Water flow rates and water consumption for fixtures shall be as follows:

Water closets:	1.6/1.1 GPF per flushing cycle
Urinals:	.125 GPF per flushing cycle
Lavatories:	0.5 GPM at 80 psi
Sinks:	2.2 GPM at 60 psi

Refer to fixture plates for selections of Basis of Design.

2.7 **DOMESTIC WATER HEATERS (ELECTRIC)**

- A. Storage Tank Type: UL 174, electric water heaters, glass-lined steel tanks, high efficiency type insulated with polyurethane foam insulation, replaceable anodes, conforming to ASHRAE 90A requirements, with adjustable range thermostat to allow hot water settings between 110 and 160 degrees F of size and capacity as shown on the drawings, as manufactured by State or approved equal. Provide posted operating instructions for water heaters. Water heaters with input ratings greater than or equal to 58 kw; or a storage capacity greater than or equal to 120 gallons shall be constructed in accordance with ASME standards and bear the ASME stamp.
- B. Furnish and install a drain pan under water heater. Drain pan shall be not less than 1-1/2" deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a minimum diameter of 1 inch or the outlet diameter of the required relief valve whichever is larger. The pan drain shall extend full size and terminate over a suitably located indirect waste receptor, floor drain or extend to the exterior of the building and terminate not less than 6 inches nor more than 24 inches above finished grade.
- C. Heater shall be covered by a 10 year limited commercial warranty against tank failure.

- 2.8 **PUMPS:** Submit for approval the manufacturer's certified characteristic performance curve for the impeller size to be furnished. Select the pump so that the operating point on the characteristic performance curve for the impeller size to be furnished will be to the left. (shut-off side) of and not more than 5 percent below the point of maximum efficiency for the impeller to be furnished.

- A. Inline Water Pumps: Capacity as indicated on the drawings.
- B. Submersible Sump Pumps: Provide factory assembled and tested submersible type pumps for operation under water. Pump shall be complete with cast-iron casing, bronze impeller, stainless steel shaft, sealed heavy-duty ball bearings, water-cooled hermetically-sealed motor, built-in automatic reset thermal protection, mercury float switch, and waterproof three-conductor cables and grounding plug.

PART 3 - EXECUTION

3.1 **INSTALLATION:** Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the ICC International Plumbing Code, except as modified herein. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply. Plastic piping shall not penetrate fire walls.

A. **Threaded Connections:** Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

B. **Pipe Supports (Hangers):** In accordance with the ICC International Plumbing Code or MSS-SP-69. Provide additional supports at the concentrated loads in piping between supports, such as for inline water pumps and flanged valves.

1. **Piping to Receive Insulation:** Provide temporary wood spacers between the insulation protection shield and the pipe in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation to be provided under Section [15250] [23 07 00], "Insulation".

2. **Maximum Spacing Between Supports:**

a. **Vertical Piping:** Support metal piping at each floor, but at not more than 10-foot intervals. Support plastic piping at 4 foot intervals.

b. **Horizontal Piping:** Support cast-iron piping at 5-foot intervals, except for pipe exceeding 5-foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. (Support plastic piping at 4-foot intervals.) Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	4	6
Steel Pipe	12	12	12	12	12	12	12	12
Copper Tube	6	6	10	10	10	10	10	10

3.2 **NAMEPLATES:** Provide laminated plastic nameplates for equipment, gages, and valves; stop valves in supplies to fixtures will not require nameplates. Laminated plastic shall be 0.125-inch thick melamine plastic, black with white center core. Surface shall be a matte finish. All corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key the nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information.

A. **Manufacturer, type, and model number**

B. **Capacity or size**

- C. System in which installed
 - D. System which it controls
- 3.3 DISINFECTION: Disinfect the new water piping in accordance with AWWA C651 or C652. Fill the piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush the solution from the systems with clean water until the chlorine is purged from the system.
- 3.4 FIELD TESTING: Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the ICC International Plumbing Code, except as modified herein. Correct all defects in the work provided by the Contractor, and repeat the tests until the work is in compliance with contract requirements.
- A. Domestic Water Piping: Before insulation is applied, hydrostatically test each piping system at not less than 100 psig with no leakage or reduction in gage pressure for 2 hours. Test the connection of new piping to existing piping at system operating pressure.
 - B. DWV Piping: Before the installation of fixtures, cap the ends of each system, fill the piping with water to the roof, and allow to stand until a thorough inspection has been made. After the plumbing fixtures have been set and their traps filled with water, subject the entire sanitary system to a final air pressure test of not more than 1.0 inch of water column. The entire system must be proven absolutely tight under such test. Test the connection of new DWV piping to existing DWV piping by flowing no less than 5 gpm of water for 5 minutes through the system and visually inspecting for leaks.
 - C. Refer to Section 15355, "Fuel Gas Piping".

END OF PLUMBING